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(71) Applicant (*for all designated States except US*): BRITAX RAINSFORDS PTY. LTD. [AU/AU]; Sherriffs Road, Lonsdale, S.A. 5160 (AU).

(72) Inventor; and
(75) Inventor/Applicant (*for US only*): VAN DE LOO, Paul [AU/AU]; 35–37 Stirling Street, Thebarton, S.A. 5031 (AU).

(74) Agent: MADDERNS; 1st Floor, 64 Hindmarsh Square, Adelaide, S.A. 5000 (AU).

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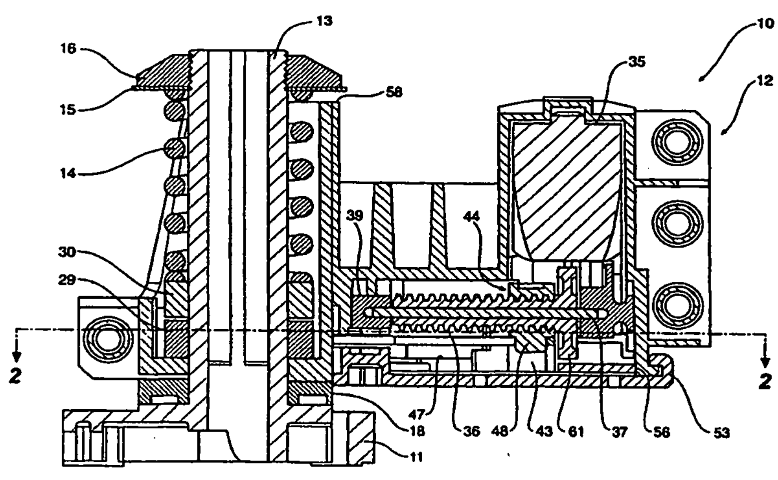

(57) Abstract

The invention relates to a rotation mechanism (10) for an external rear view mirror for a motor vehicle, which moves the mirror from a deployed in–use position to a parked position where it is as closed to the vehicle body as possible. The invention comprises a mounting bracket (11), a mirror head rotatably supported on the mounting bracket (11), a lead screw (36) rotatably journalled within said mirror head, a drive means (35) to rotate the lead screw (36), and a nut member (43) that is threadably engaged to the lead screw (36) and which is held with respect to the mounting bracket (11) so that the mirror head is caused to rotate with respect to the mounting bracket (11) and the drive means (35) rotates the lead screw (36) with respect to the nut member (43). The invention provides a more robust drive means to move a mirror head by comparison to conventional worm drive gears and spur gears, which are not generally suited to applications where higher loads are required to move the mirror head.

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A MIRROR ROTATION MECHANISM

This invention relates to a mirror rotation mechanism, and in particular to a mechanism which is able to move a mirror from an in-use driving or deployed position to a second position such as an intermediate or parked position.

BACKGROUND OF THE INVENTION

The invention will be described in relation to its application to a wing or side mirror used on motor vehicles. However, it should be realised that the rotation mechanism may be used with other devices not necessarily mirrors, and therefore the invention should not be restricted to the specific application described in this specification.

Mirror heads are designed to rotate about a substantially vertical pivot point both forwards or backwards. It is conventional for a mirror head to be held in its driving position by detents which allow manual movement of the mirror housing to a park position or deflection as a result of being hit by passing traffic or colliding with an obstruction. With the mirror parked, the mirror head is substantially parallel to the side of the vehicle which in turn reduces the risk of impact or interference from passing pedestrians or vehicles. It is particularly useful when the vehicle is parked in or travelling along a narrow or congested roadway.

Typically, known automatic parking mechanisms are designed to drive the mirror head from its normal deployed position by applying sufficient torque or drive force to overcome the holding power of a mirror head detent. In addition, extra detents are required to have a greater breaking torque than the first set to enable manual breakaway of the mirror and associated drive means if the mirror head is impacted. One such operating mechanism is described in the present applicant's Australian Patent Application No 68997/98 titled "A Mirror Operating Mechanism".

Although the operating mechanism described in the abovementioned Australian patent is ideally suited to movement of wing mirrors, it has some limitations on the size of mirror for which it can be used and some limitations in relation to loads that can be withstood by some of the components. For example, breakaway forces are absorbed by some of the gearing components which are ideally manufactured by plastic injection moulding. However, the meshing loads that can be resisted by these components is limited and if excessive force is applied, particularly between a fine toothed spur gear wheel and a worm drive, stripping of the spur gear can readily occur.

Therefore, for some applications, such as larger mirrors that may be used on trucks or light trucks, it is highly likely that excessive loads would be applied to gears similar to those shown in the abovementioned Australian patent. Accordingly, it would be desirable to overcome this particular problem and provide a drive means which is able to withstand significant loads.

Another problem that may be encountered is backlash or free play within the drive means or drive train used within the drive means. If free play exists, then this will result in a mirror head being able to move to the extent of the free play. This is clearly undesirable, particularly when the mirror head is in its operative or deployed position. Accordingly, it is a further object of this invention to overcome this particular problem.

SUMMARY OF THE INVENTION

In its broadest form, the invention is a rotation mechanism for an exterior rear view mirror comprising:

a mounting bracket,

a mirror head rotatably supported on said mounting bracket,

a lead screw rotatably journalled in said mirror head,

a drive means to rotate said lead screw,

a nut member threadably engaged to said lead screw that is held with respect to said mounting bracket so that said mirror head rotates with respect to said mounting bracket when said drive means rotates said lead screw with respect to said nut member.

The use of a lead screw and nut provides a means of moving a mirror head that is significantly more robust by comparison to a typical worm gear meshing with a spur gear. The lead screw and nut have a much greater contact area by comparison to a spur gear and worm drive. Hence, stresses in these components are much lower for the same load, and they are able to carry larger loads. Accordingly, this arrangement is both able to provide a sufficient range of movement as well as resisting significant forces that may be applied to the mirror head and directly transferred to the lead screw.

Preferably, the invention further comprises a link member which forms a connection between the nut member and a connection point held with respect to the mounting bracket.

Preferably, the lead screw is driven by an electric motor by way of typical reduction gearing such as a worm and spur gear drive. Any force applied to the mirror head is transferred directly to the lead screw, and therefore will not result in any significant force being applied to a worm drive on the lead screw.

The extent of movement of the mirror head with respect to the mounting bracket can be controlled by stops which determine the extent of travel of the mirror head. These stops can be used to resist further movement of the mirror head which in turn results in increased current draw by the motor. Circuitry may be provided which senses this current increase which in turn is used to de-energise the motor operation.

The invention may be provided with detents which allow breakaway movement of the mirror head when it is impacted or otherwise has force applied to it. Preferably, the detent is arranged to automatically return to its rest position once the force is removed.

The lead screw may also be rotatably journalled within the mounting bracket. In this case, the drive means would likewise be located in the bracket. However, the nut member would be held in respect of the mirror head.

Preferably, the rotation mechanism further comprises a first ramped surface on said mounting bracket and a second ramped surface on said mirror head that abuts against and is contiguous with the first ramped surface. The ramped surfaces act to apply a load to the lead screw once the mirror head is driven to its deployed position. The extent of the load is sufficient to prevent free play between the lead screw, nut and other components such as linkage members and other connections between the spigot and mirror head which would otherwise allow the mirror head to move or vibrate.

The drive means causes the ramped surfaces to engage and for the mirror head and mounting bracket to separate slightly under the force of the spring means. Preferably, the mounting bracket has a substantially vertical spigot to which the mirror head is rotatably mounted. Ideally, the spring means comprises a coil spring which has one end bearing against the mirror head, and the other end being restrained at the upper end of the spigot.

The engagement of the ramped surfaces and slight separation of the mirror head and mounting bracket will result, when the drive means is stopped, in the ramped surfaces causing a load to be applied to the lead screw so that free play within the drive means is taken up. This will obviously result in the mirror head remaining quite firm on the mounting bracket when it reaches the end of its travel.

This will be particularly useful in respect of when the mirror head is in its deployed position.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment will now be described, but it should be realised that the invention is not to be confined or restricted to the precise details of the embodiment described.

The embodiment is illustrated in the accompanying drawings in which:

Fig 1 shows a cross-sectional assembled view of a right hand side mirror rotation mechanism in a deployed position about section line 1-1 shown in Fig 2,

Fig 2 shows a cross-sectional assembled view of a right hand side mirror rotation mechanism in a deployed position about section line 2-2 shown in Fig 1, and

Figs 3 and 4 show exploded views of a mirror rotation mechanism illustrated in Fig 1.

DETAILED DESCRIPTION

The following description of the embodiment, together with the mechanism shown in the drawings, is for a right hand version of a wing mirror. The invention will be equally suited to a left hand side wing mirror, which requires obvious changes in some of the components.

The mirror rotation mechanism 10 comprises a mounting bracket 11 and a casing 12 which is attached to the mounting bracket 11 for pivotal movement. The mounting bracket 11 has a spigot 13 about which the casing 12 rotates. A coil spring 14 is located on the spigot 13 with one end applying force to the casing 12, and the other end bearing against a retaining plate 15.

The mounting bracket 11 is secured to the side of a vehicle. The mounting bracket may be designed to secure directly to the vehicle, or alternatively, the

mounting bracket 11, as shown in Fig 1, is designed to be secured to another bracket which is in turn secured to the side of the vehicle.

The casing 12 is designed to rotate about the spigot 13, and in turn has a mirror head housing (not illustrated) attached to the casing.

A ring 18 is journalled for rotation about the spigot 13. The ring 18 has three arcuate recesses 19 wherein each recess 19 locates over a projection 20 that is located on the mounting bracket 11. The ring 18 is therefore able to rotate only to a limited extent which is governed by the projections 20 engaging against the end of the arcuate recesses 19.

The upper surface of the ring 18 has three recesses 22 with each end of each recess 22 having a ramped surface 24 at an angle of 10 degrees to the horizontal and angled surfaces 23 at 45 degrees.

The casing 12 has an aperture 25 through which the spigot 13 locates. This enables the casing 12 to rotate with respect to the spigot 13. There are three projections 26 radially spaced around the aperture 25 which locate within the recesses 22. Each of the projections 26 have ramped surfaces 27 which will abut against respective ramped surfaces 24 and angled surfaces 28 that abut against ramped surfaces 23.

The breakaway detent mechanism comprises a pair of rings 29 and 30 that are both located on the spigot 13. The lower ring 29 locates on the base surface of the casing 12. It is also free to rotate with respect to the spigot 13. The upper ring 30 has a pair of splines 31 that locate within longitudinal slots 32 in the spigot 13. This results in the upper ring 30 not being able to rotate with respect to the spigot 13, but being able to move along the axis of the spigot 13.

Each of the rings 29 and 30 have a series of mating helical surfaces 33 and 34. Relative rotation between the upper and lower rings 29 and 30 results in longitudinal separation of the rings 29 and 30 with respect to the spigot 13.

A coil spring 14 bears against the upper surface of ring 30, and is held in a compressed state by retaining plate 15 and retainer 16 that is threadably secured to the end of the spigot 13.

The drive means is also located within the housing 12. In this embodiment, the drive means comprises an electric motor 35 which drives a lead screw 36 via a worm drive 60 and a spur gear 61. The lead screw 36 is journalled to the housing 12 via a shaft 37 so that it rotates with respect to the housing 12. One end of the shaft 37 is located within a bearing support 38 and the other end of the shaft 37 is located within bearing support 39. As can be seen from Fig 3, bearing support 38 has a pair of legs 40 and projections 41. The projections 41 locate within recesses in the housing 12 to prevent movement of the bearing support 38 with respect to the longitudinal axis of the lead screw. The nut member comprises a carriage 43 that has a threaded aperture 44 which is threadably engaged to the lead screw 36. The carriage 43 is designed to move longitudinally along the lead screw 36. The carriage 43 has surfaces 45 that locate between the legs 40 to guide movement of the carriage 43.

A link member 47 is connected between the carriage 43 and the lower ring 29. The carriage 43 is provided with a spigot 48 that is engaged by an aperture 49 in the link member 47. The lower ring 29 has a lever arm 50 which also carries a spigot that is engaged by aperture 51 of the link member 47.

A lid 53 closes the housing 12 and retains the bearing support 38 and carriage 43 in place. In addition, the link member 47 is located between a pair of plastic sealing pads 54 which help to prevent ingress of dust into the housing 12.

Operating sequences of the mirror rotation mechanism 10 will now be described. The first operating sequence described is parking of the mirror.

Operation of the electric motor 35 causes rotation of the lead screw 36. The carriage 43 is held in a constant distance from the spigot 13 by the link member 47. Accordingly, the lead screw is caused to move through the threaded aperture 44 which in turn means that, as the spigot on lever arm 50 is spaced with respect to the axis of the spigot 13, the housing 12 is caused to rotate. The mirror rotation mechanism 10 is shown in Fig 1 with the housing 12 in its deployed position. Rotation of the lead screw 36 results in movement of the carriage 43 with respect to the bearing support 38. Referring to Fig 1, the threaded aperture 44 moves from right to left along the lead screw 36.

The lower ring 29 is restrained from rotating relative to the spigot by the upper ring 30. The upper ring 30 in turn is restrained from rotating with respect to the spigot 13 via the splines 31 that engage the spigot 13. Operation of the lead screw 36 in the manner described above results in the casing 12 rotating towards the rear of the vehicle.

This rotation rearwardly will continue until the casing 12 hits a physical stop. This may comprise some feature within the mirror head (not drawn) abutting the projection 59 on the retaining plate 15. This halt to movement of the mirror head will cause a surge in electrical current within the motor 35 that can be sensed and result in the motor being de-energised.

If a physical stop, such as the mirror head contacting the vehicle body, is not provided, then movement of the casing 12 will be limited by the projections 20 abutting against the ends of the recesses 19. This results in the ring 18 being prevented from further rotation which in turn will stop the movement of the casing 12. The carriage 43 reaching either end of the lead screw 36 will also limit the movement of the casing 12.

Operation of the electric motor 35 in the reverse direction will cause outward movement of the casing 12. In this case, the electric motor 35 will drive the lead screw 36 in the opposite direction. Again, as the carriage 43 is restrained from rotating with the lead screw 36, it moves from left to right (with reference to Fig 1). As the carriage 43 is held at a constant distance from the spigot 13 by the link member 47, the mirror head 12 rotates to its deployed position. The deployed position can be sensed by rising motor current which is used to limit further rotational movement of the casing 12.

One disadvantage of the use of the lead screw 36 is backlash or free play between the lead screw 36 and threaded aperture 44 and other components in the drive chain such as the carriage 43 and link member 47. Clearance is normally provided between the mating threads of the lead screw 36 and the aperture 44 which results in some backlash or free play. Obviously, if unrestrained, the mirror head would be able to move slightly once it reaches its deployed position. This movement is undesirable and will obviously result in vibration of the mirror head in normal use.

In order to overcome the backlash problem, the electric motor 35 may be driven until the respective ramped surfaces 24 and 27 engage and move with respect to one another. The angle of the ramped surfaces 24 and 27 (10 degrees to horizontal) is such that the electric motor 35 has sufficient torque to enable some compression of the coil spring 14 when the casing 12 is moving to its deployed position. This results in the casing 12 separating slightly from the mounting bracket 11 and ring 18. At the deployed position, the projections 20 abut against the end of the recesses 19. This prevents further rotation of ring 18. The casing 12 continues to be driven which results in relative movement between the ramp surfaces 24 and 27 until the rise in motor current stops the motor 35. Movement between the ramped surfaces 24 and 27 is resisted by spring 14. The angle of the ramped surfaces 24 and 27 is sufficient such that the force provided by the coil spring 14 is sufficient to cause those ramped

surfaces 24 and 27 to tend to slide with respect to one another. This means that a load is applied to the lead screw 36 once the casing 12 reaches its deployed position which is in the same direction as the load required to drive the casing 12 to its deployed position. This prevents any movement of the mirror casing 12 due to backlash between components of the drive means.

The angled surfaces 23 and 28 are sufficiently steep to cause the ring 18 to rotate with the casing 12 when it is moving to a parked position, but shallow enough to allow the casing 12 to be manually moved with respect to the ring 18. This may be necessary if the projections 26 were to become engaged in the wrong recesses 22.

A second and third mode of operation of the mirror rotation mechanism 10 is rear and forward breakaway. Breakaway allows movement of the mirror head if it is impacted such as by passing traffic or by hitting an obstruction. Rearward breakaway is defined as the mirror head moving towards the rear of the vehicle.

If the mirror head is impacted when in its normal deployed position such that it is forced to move rearwardly, then the force is transmitted by the casing 12 as a torque about spigot 13. This force is transmitted via the carriage 43 which is unable to move with respect to the lead screw 36. This causes the link member 47 to apply force to the lever arm 50. This in turn causes rotation movement of the lower ring 29 with respect to the spigot 13.

Rotation of the lower ring 29 is resisted by the upper ring 30 which is prevented from rotating with respect to the spigot 13 via the splines 31. This causes initial sliding movement between ramped surfaces 33 that are on both the upper and lower rings 29 and 30, sliding of the upper ring 30 along the spigot 13 and compression of spring 14. Continued torque being applied to the lower ring 29 will cause it to rotate with respect to the upper ring 30. This will in turn initially cause sliding movement between the ramped surfaces 33 of the upper and lower rings 29 and 30. Provided that the force continues to be applied, ramped surfaces 33 will

disengage and allow ramped surfaces 34 of the upper and lower rings 29 and 30 to engage.

The helical angle of the ramped surfaces 33 is much greater by comparison to the helical angle of the ramped surfaces 34. Therefore, once the ramped surfaces 34 engage, less force is required to continue rotation of the mirror head.

Separation of the upper and lower rings 29 and 30 will in turn result in the casing 12 and attached mirror head being able to rotate in a rearward direction. Once the movement force is removed, the angle of the ramped surfaces 34 will, in combination with the compressed coil spring 14, provide sufficient torque to cause rotation of the mirror head back into its operative position. The extent of rotation of the mirror head when the force is applied will be limited by some feature within the mirror head (not drawn) abutting the projection 59 on the retaining plate 15.

The operation of the breakaway mechanism is the same in the forward direction as it is in the rearward direction. Again, the extent of rotation in the forward direction is limited by some feature within the mirror head (not drawn) abutting the projection 59 on the retaining plate 15.

However, the force applied to the mirror head is transmitted to the upper and lower rings 29 and 30 in the same way that it is for the rear breakaway. The ramped surfaces 33 and 34 operate in the same way to allow forward rotation to the mirror head, and the ramped surfaces 34 are designed to return the mirror head to its operating position.

Another advantage of the invention is the ability of the mirror rotation mechanism 10 to withstand significant bending moments which may result from downward loads applied to the end of the mirror head. In order to enable the spigot 13 to withstand such high loadings, it is necessary to design the mirror rotation mechanism 10 so that the forces result in the spigot 13 being placed in tension rather

than the forces being applied as a bending moment to the spigot 13. When a vertical force is applied to the mirror head at a distance from the spigot 13, the force is transmitted to the casing 12 as a moment having an axis normal to the vertical axis of the spigot 13. The casing 12 will rotate slightly due to this force and this will result in a partial disengagement of the casing 12 from the ring 18. This rotation causes the upper end of the cylindrical wall 58 that is part of the casing 12 to abut against the retaining plate 15. Therefore, the bending moment is transmitted to the retaining plate 15 which is held in place by the retainer 16. In turn, the bending moment force is transmitted to the spigot 13 as a tension force. The spigot 13 has a significantly higher strength in tension than it does in bending. This would enable the spigot 13 and mounting bracket 11 to be manufactured in a lower strength material such as a plastic material.

The invention described above has the main advantage in that it removes inherent high gear load problems if a series of spur gears and worm drives were used. This in turn eliminates the need for higher strength material such as metal gearing that would significantly increase the cost of the mechanism 10. In addition, the use of ramped surfaces 24 and 27 enable backlash to be eliminated to thereby significantly reduce vibration problems.

CLAIMS

1. A rotation mechanism for an external rear view mirror comprising:

a mounting bracket,

a mirror head rotatably supported on said mounting bracket,

a lead screw rotatably journalled in said mirror head,

a drive means to rotate said lead screw,

a nut member threadably engaged to said lead screw that is held with respect to said mounting bracket so that said mirror head rotates with respect to said mounting bracket when said drive means rotates said lead screw with respect to said nut member.

2. A rotation mechanism according to claim 1 further comprising a link member attached at one end to said nut member with the other end extending to and connected to said mounting bracket.

3. A rotation mechanism according to claim 2 wherein said mounting bracket further comprises a spigot about which said mirror head is journalled for rotation.

4. A rotation mechanism according to claim 3 further comprising a lever arm secured to said spigot and extending substantially normal to the axis of said spigot, an end of said link member attached to said lever arm.

5. A rotation mechanism according to claim 4 wherein said lever arm is attached to a first ring that is rotatably journalled to said spigot and further comprising a breakaway clutch which restrains relative rotation between said first ring and said spigot but which allows said first ring to rotate with respect to said spigot when a predetermined force is applied to said lever arm.

6. A rotation mechanism according to claim 5 wherein said clutch comprises

a plurality of walls defining recesses in the upper surface of said first ring, and

a second ring located on said spigot above said first ring having a plurality of projections that locate within said first ring recesses which restrain relative rotation between said first and second rings, said second ring being slidable along said spigot but restrained from rotation with respect to it.

7. A rotation mechanism according to claim 6 further comprising

at least one channel extending the length of said spigot,

at least one projection on said second ring that locates within said respective channel that allows said second ring to slide along said spigot but which prevents its rotation with respect to said spigot, and

a spring acting between said second ring and the end of said spigot that pushes said first and second ring together.

8. A rotation mechanism according to claim 6 wherein said walls defining recesses in said first ring include helical surfaces on either side of a recess and wherein said projections include helical surfaces that abut against said helical surfaces of said first ring.

9. A rotation mechanism according to claim 8 wherein two pairs of helical surfaces are provided on each said recess and projection, the inner pairs of recesses having a steeper angle with respect to the outer pairs.

10. A rotation mechanism for an external rear view mirror comprising

a mounting bracket,

a spigot on said mounting bracket,

a mirror head rotatably journalled to said spigot,

a lead screw rotatably journalled in said mirror head,

a drive means to rotate said lead screw,

a nut member threadably engaged to said lead screw that is held with respect to said spigot so that said mirror head rotates with respect to said mounting bracket when said drive means rotates said lead screw with respect to said nut member, and

a break away clutch which allows said mirror head to be rotated with respect to said spigot without operation of said drive means.

11. A rotation mechanism according to claim 10 further comprising a link member attached at one end to said nut member with the other end extending to and connected to said mounting bracket.

12. A rotation mechanism according to claim 11 further comprising a lever arm secured to said spigot and extending substantially normal to the axis of said spigot, an end of said link member attached to said lever arm.

13. A rotation mechanism according to claim 12 wherein said lever arm is attached to a first ring that is rotatably journalled to said spigot.

14. A rotation mechanism according to claim 13 wherein said break away clutch comprises:

a plurality of walls defining recesses in the upper surface of said first ring, and

a second ring located on said spigot above said first ring having a plurality of projections that locate within said first ring recesses which restrain relative rotation between said first and second rings, said second ring being slidable along said spigot but restrained from rotation with respect to it.

15. A rotation mechanism according to claim 14 further comprising:

at least one channel extending the length of said spigot,

at least one projection on said second ring that locates within said respective channel that allows said second ring to slide along said spigot but which prevents its rotation with respect to said spigot, and

a spring acting between said second ring and the end of said spigot that pushes said first and second ring together.

16. A rotation mechanism according to claim 14 wherein said walls defining recesses in said first ring include helical surfaces on either side of a recess and wherein said projections include helical surfaces that abut against said helical surfaces of said first ring.

17. A rotation mechanism according to claim 16 wherein two pairs of helical surfaces are provided on each said recess and projection, the inner pairs of recesses having a steeper angle with respect to the outer pairs.

18. A rotation mechanism for an external rear view mirror comprising:

a mounting bracket,

a mirror head rotatably supported on said mounting bracket,

a spring means acting between said mirror mounting bracket and said mirror head that resists separation of said mirror from said mounting bracket along the axis of rotation between them,

a lead screw rotatably journalled in said mirror head,

a drive means to rotate said lead screw,

a nut member threadably engaged to said lead screw that is held with respect to said mounting bracket so that said mirror head rotates with respect to said mounting bracket when said drive means rotates said lead screw with respect to said nut member.

19. A rotation mechanism according to claim 18 further comprising a first ramped surface on said mounting bracket and a second ramped surface on said mirror head that abuts against and is contiguous with said first ramped surface, said ramped surfaces allowing a relative rotation between said mounting bracket and said mirror head upon said mirror head reaching its deployed position which results in a load being applied to said lead screw to prevent movement of said mirror head due to backlash between said nut member and said lead screw.

20. A rotation mechanism according to claim 19 further comprising three ramped surfaces on said mounting bracket and mirror head.

21. A rotation mechanism according to either claim 19 or claim 20 wherein said ramped surfaces are between 5° to 15° with respect to a horizontal reference.

22. A rotation mechanism according to claim 19 wherein said first and second ramped surfaces are angled so that relative rotation between said mounting bracket and mirror head occur as said mirror head is being rotated from its parked position where it is closest to a vehicle body to its in use position.

23. A rotation mechanism according to claim 19 wherein said mounting bracket further comprises a spigot about which said mirror head is journalled for rotation.

24. A rotation mechanism according to claim 23 further comprising a link member attached at one end to said nut member with the other end extending to and connected with respect to said spigot.

25. A rotation mechanism according to claim 24 further comprising a lever arm secured to said spigot and extending substantially normal to the axis of said spigot, an end of said link member attached to said lever arm.

26. A rotation mechanism according to claim 25 wherein said lever arm is attached to a first ring that is rotatably journalled to said spigot and further comprising a breakaway clutch which restrains relative rotation between said first ring and said spigot but which allows said first ring to rotate with respect to said spigot when a predetermined force is applied to said lever arm.

27. A rotation mechanism according to claim 26 wherein said clutch comprises a plurality of walls defining recesses in the upper surface of said first ring, and

a second ring located on said spigot above said first ring having a plurality of projections that locate within said first ring recesses which restrain relative rotation between said first and second rings, said second ring being slidable along said spigot but restrained from rotation with respect to it.

28. A rotation mechanism according to claim 27 further comprising

at least one channel extending the length of said spigot,

at least one projection on said second ring that locates within said respective channel that allows said second ring to slide along said spigot but which prevents its rotation with respect to said spigot, and

a spring acting between said second ring and the end of said spigot that pushes said first and second ring together.

29. A rotation mechanism according to claim 27 wherein said walls defining recesses in said first ring include helical surfaces on either side of a recess and wherein said projections include helical surfaces that abut against said helical surfaces of said first ring.

30. A rotation mechanism according to claim 29 wherein two pairs of helical surfaces are provided on each said recess and projection, the inner pairs of recesses having a steeper angle with respect to the outer pairs.

31. A rear view mirror comprising:

a mounting bracket,

a spigot on said mounting bracket,

a mirror head rotatably journalled to said spigot,

spring means acting between said mirror mounting bracket and said mirror head that resists separation of said mirror head from said mounting bracket,

a flange on the end of said spigot, and

abutment means on said mirror head that bears against said flange when force is applied to said mirror head that causes it to rotate about an horizontal axis so that said abutment means applies a substantially tensile force to said spigot.

32. A rotation mechanism for an external rear view mirror comprising:

a mounting bracket,

a mirror head rotatably supported on said mounting bracket,

a lead screw rotatably journalled in said mounting bracket,

a drive means to rotate said lead screw,

a nut member threadably engaged to said lead screw that is held with respect to said mirror head so that said mirror head rotates with respect to said mounting bracket when said drive means rotates said lead screw with respect to said nut member.

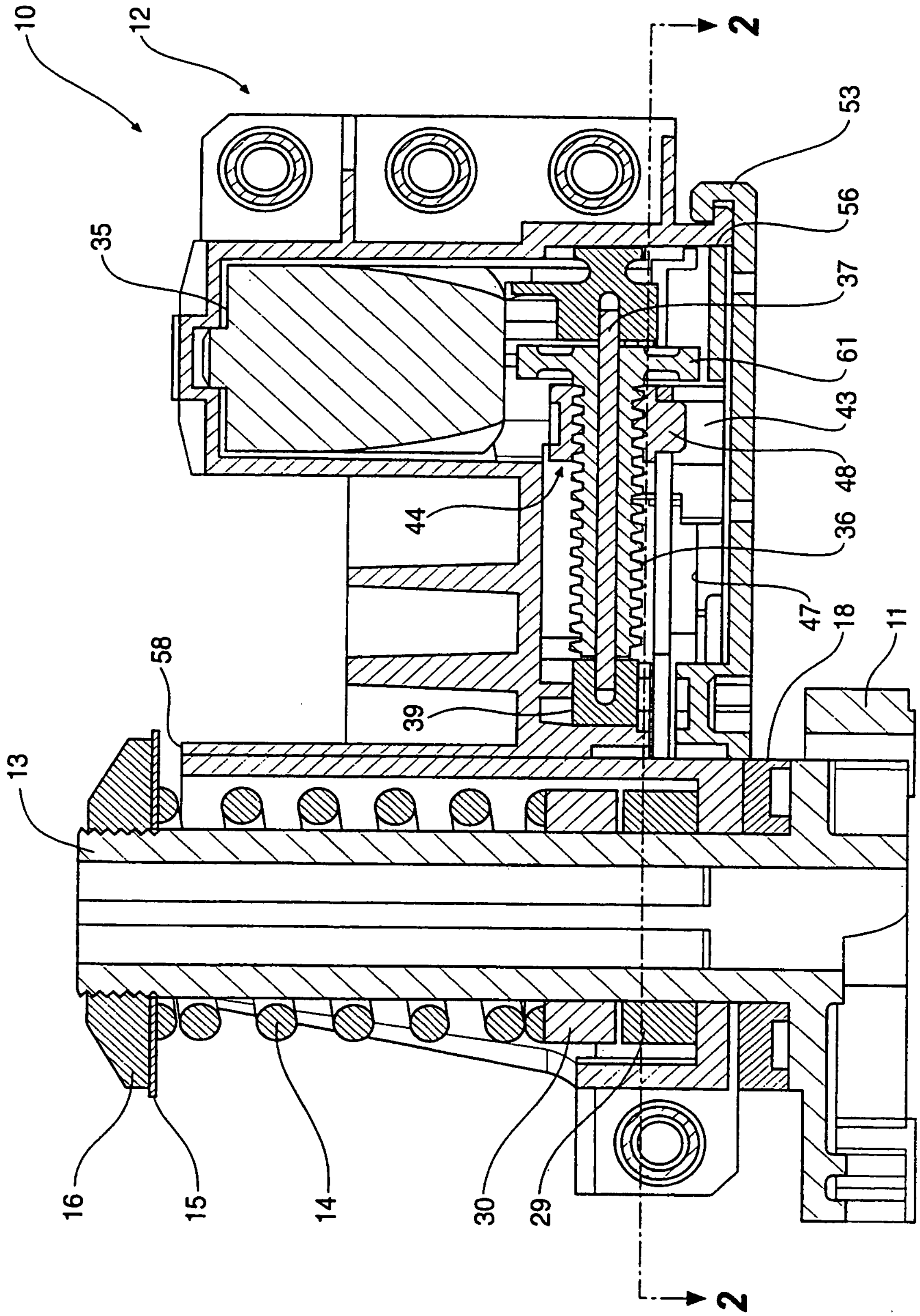

Fig 1

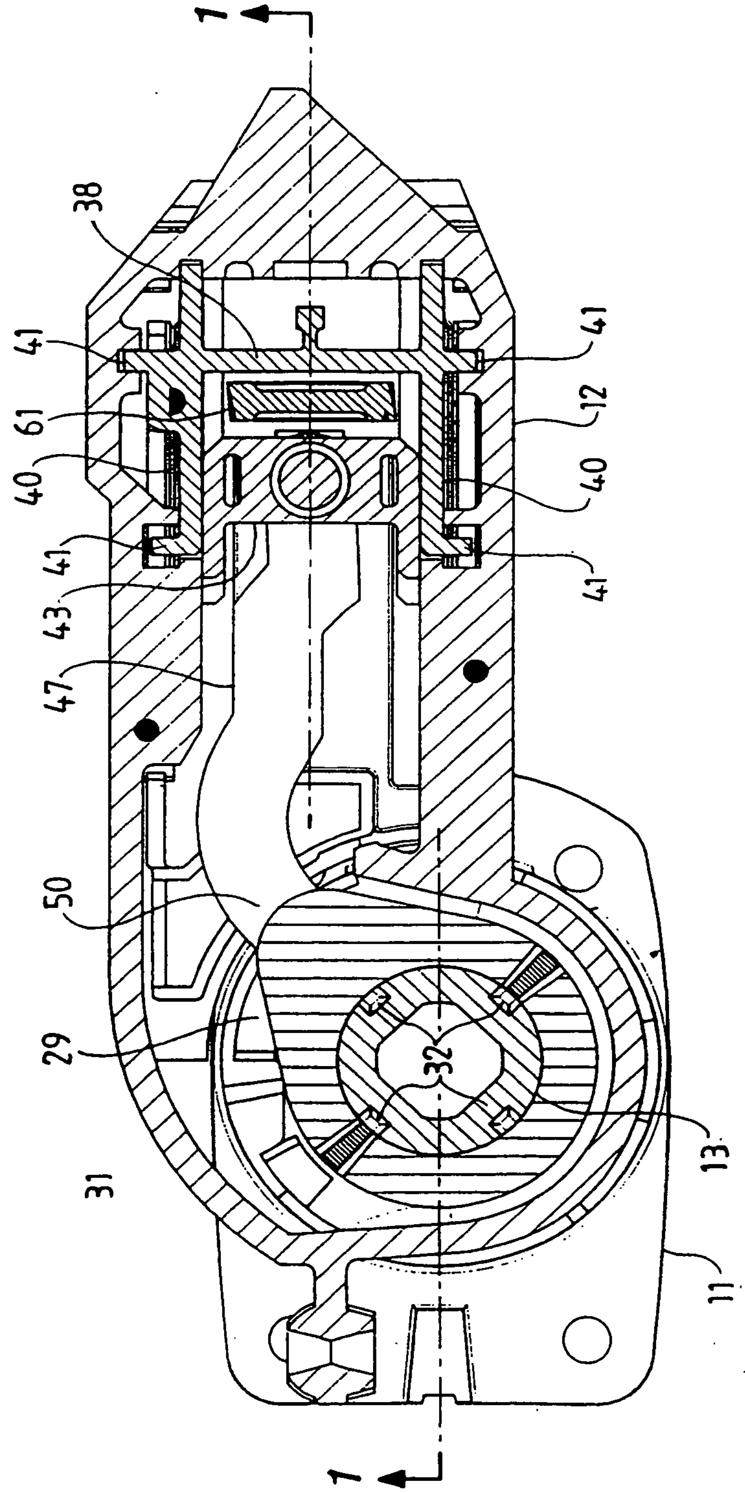

FIG 2

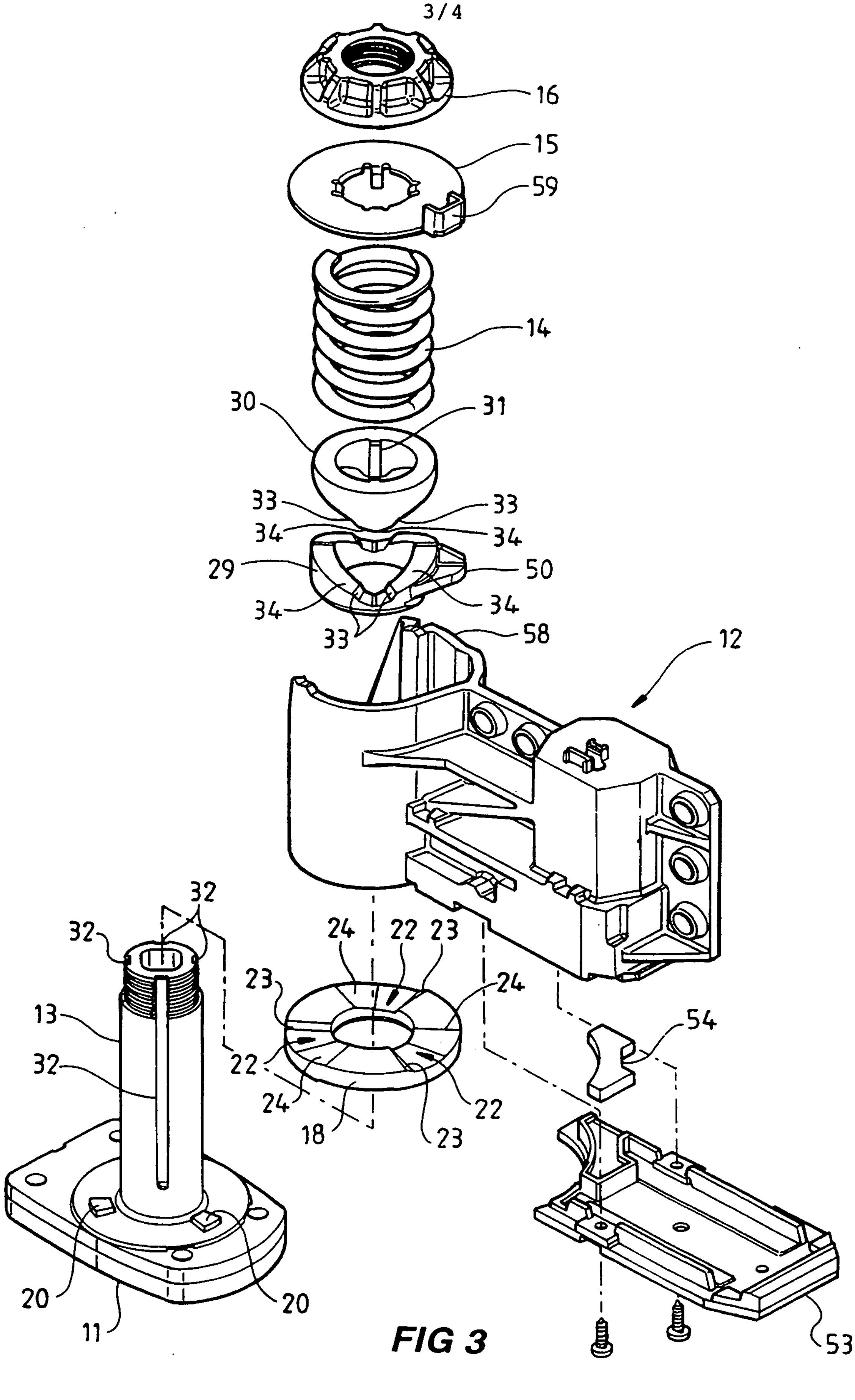
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FIG 3

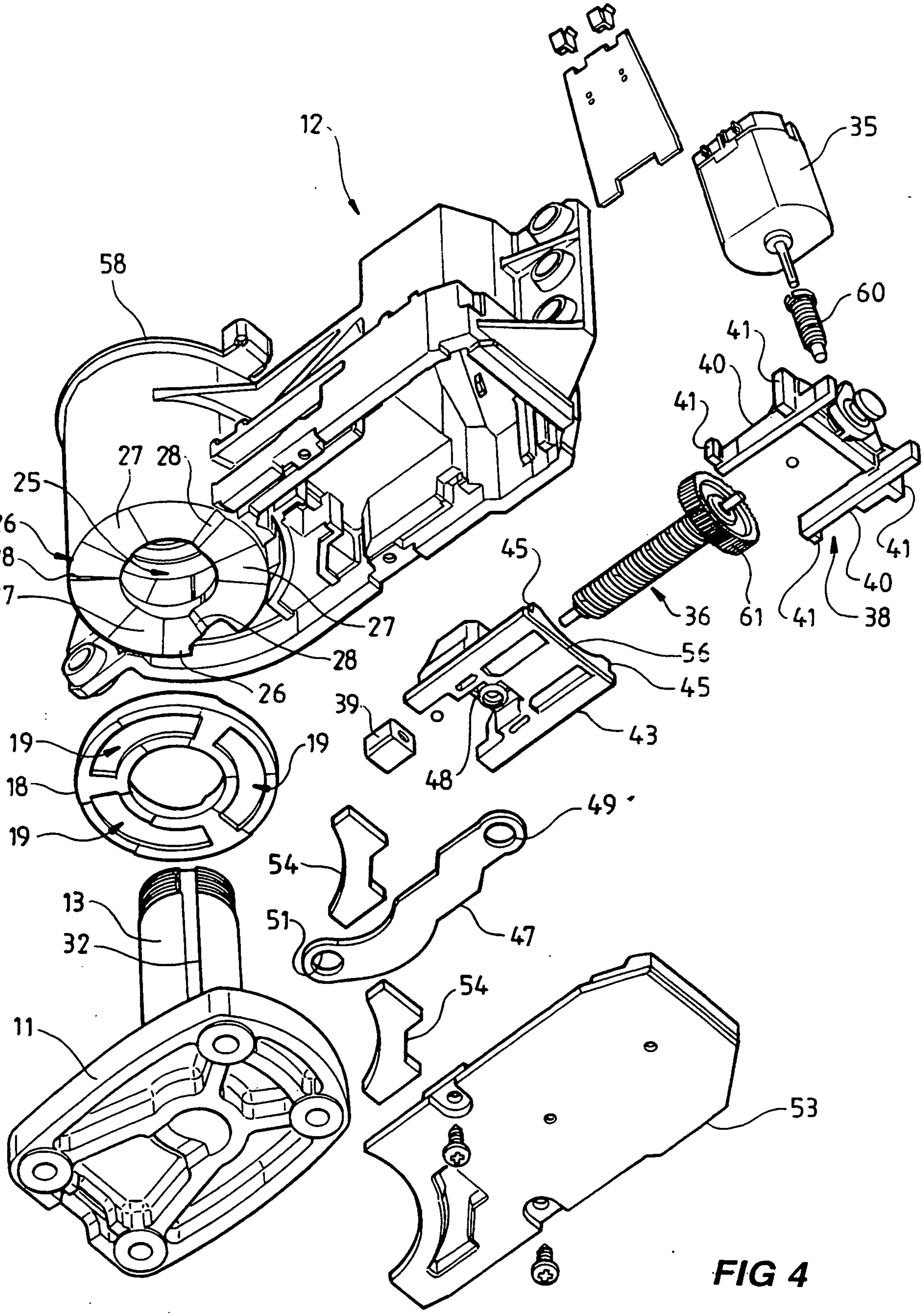
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FIG 4